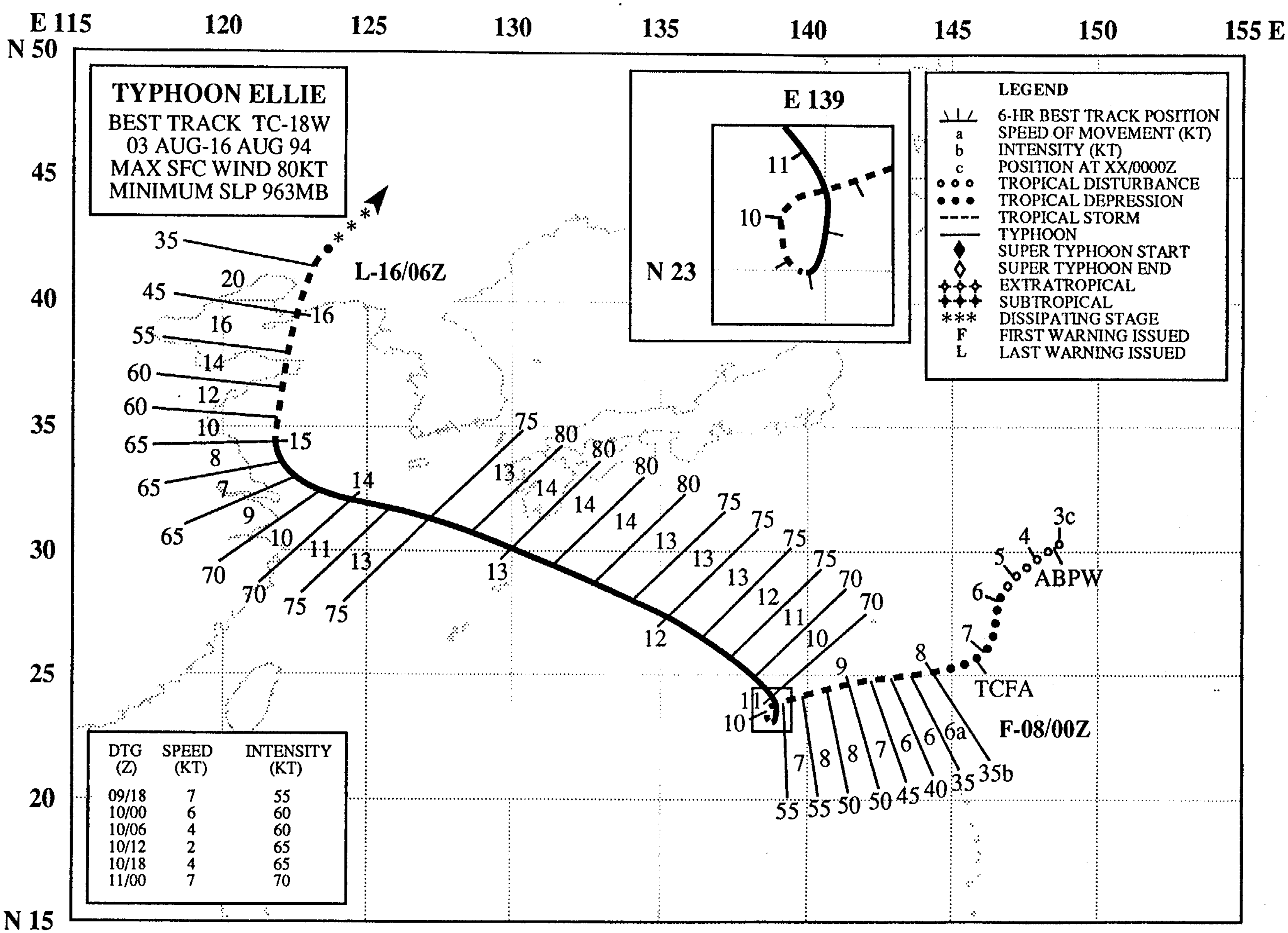
TYPHOON ELLIE
BEST TRACK TC-18W
03 AUG-16 AUG 94
MAX SFC WIND 80KT
MINIMUM SLP 963MB
E 115
120
125
130
135
140
145
150
155 E
N 50
45
40
35
30
25
20
N 15
E 139
N 23
LEGEND
6-HR BEST TRACK POSITION
a SPEED OF MOVEMENT (KT)
b INTENSITY (KT)
c POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
SUBTROPICAL
*** DISSIPATING STAGE
F FIRST WARNING ISSUED
L LAST WARNING ISSUED
L-16/06Z
ABPW
TCFA
F-08/00Z
DTG (Z)
SPEED (KT)
INTENSITY (KT)
09/18 7 55
10/00 6 60
10/06 4 60
10/12 2 65
10/18 4 65
11/00 7 70

TYPHOON ELLIE (18W)

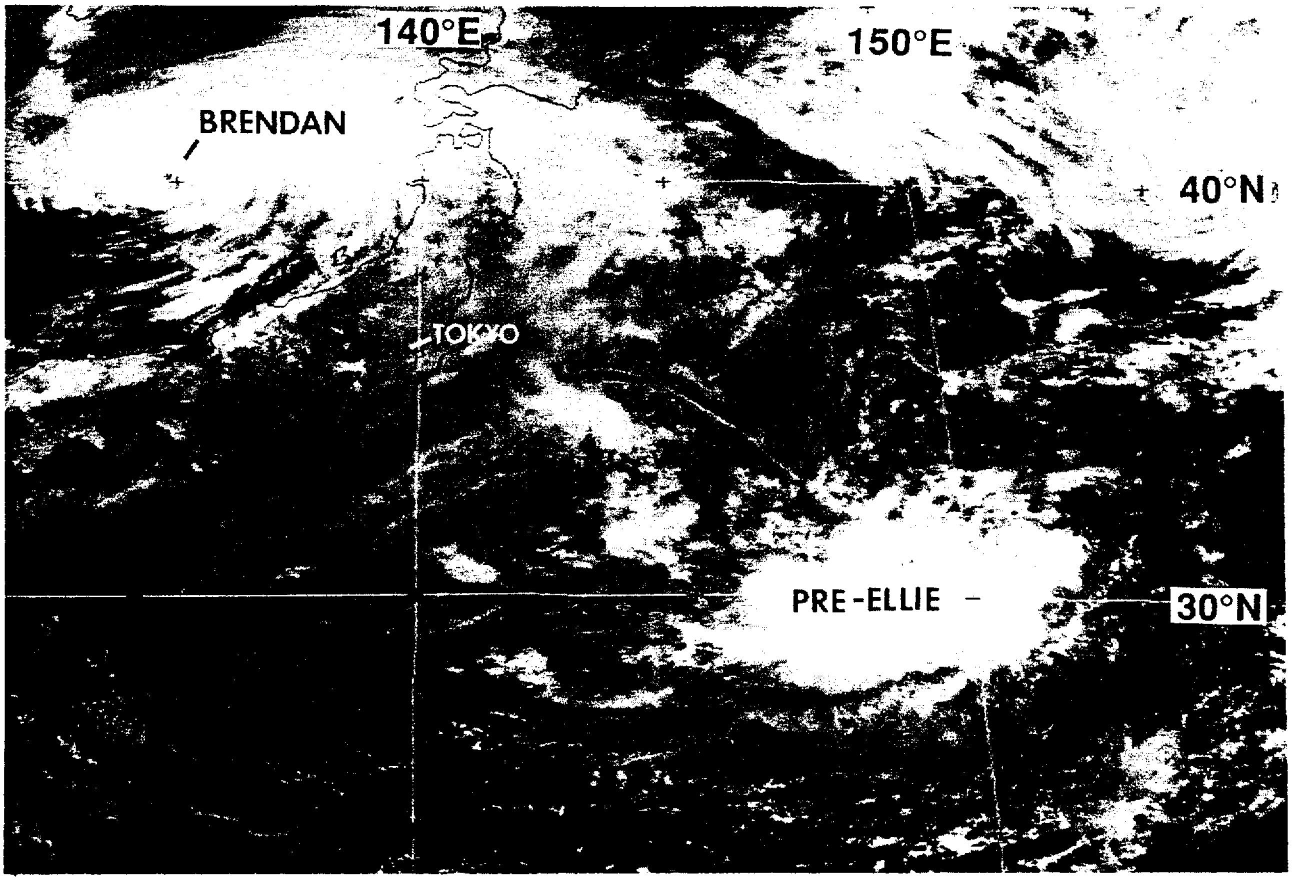

Figure 3-18-1 The small area of deep convection at the base of a weak mid-latitude trough drifted southward and became Ellie. The recurving Brendan is seen in the Sea of Japan (020031Z August visible GMS imagery).

I. HIGHLIGHTS

The tropical disturbance that became Ellie had an atypical origin in the sub-tropics about 500 nm (900 km) east-southeast of Tokyo. Ellie became a large typhoon with a large ragged eye. Prior to recurvature in the Yellow Sea, it moved on a westward track at high latitude (25°N). A peak wind gust of 87 kt (45 m/sec) was recorded by a station on the south coast of Kyushu, Japan, as Ellie passed 60 nm (110 km) to the south.

II. TRACK AND INTENSITY

On 02 August, an area of deep convection was observed at the base of a weak trough of low pressure which was moving eastward away from Japan (Figure 3-18-1). Drifting slowly southward, this area of deep convection persisted, prompting its first mention on the 030600Z August Significant Tropical Weather Advisory. For the next several days, this tropical disturbance continued to move slowly southward, and the areal extent of deep convection increased. An exposed low-level circulation center on the northern side of the deep convection became increasingly well defined. At 070630Z, a Tropical Cyclone Formation Alert was issued based upon increasing curvature of the main band of deep convection. At 080000Z, the first warning was issued on Tropical Depression 18W. By 081200Z, the system was upgraded to Tropical Storm Ellie based upon synoptic data from the Volcano Islands [Chi Chi Jima (WMO 47971) recorded a peak gust of 48 kt (25 m/sec) and a minimum sea-level pressure of 1002.1 mb as the system passed nearby]. The system gradually turned to the west-southwest. On the morning of 09 August, a large ragged eye formed (Figure 3-18-2). On 10 August, the system stalled for approximately 24 hours, intensified, and grew in size. As it came out of its stall, Ellie moved on a west-northwestward track at a steady 13 kt (24 km/hr) for the next 72 hours (110600Z to 140600Z). At 110600Z, the system was upgraded to Typhoon Ellie, however post-analysis indicated that typhoon intensity was most probably reached at 101200Z. After becoming a typhoon, Ellie's intensity increased very slowly, reaching a peak of 80 kt (41 m/sec) at 121200Z. Throughout the entire period during which Ellie was at typhoon intensity (101200Z to 150000Z), the eye remained large (i.e., diameter in excess of 45 nm) and ragged, and the areal extent of the outer circulation was very large (Figure 3-18-3). At 130000Z, Ellie passed within 90 nm (170 km) of the southern coast of Kyushu. A comprehensive data set of peak wind and minimum sea-level pressure was obtained from stations in Japan (Figure 3-18-4). After 140600Z, Ellie turned northward and slowly weakened. It briefly touched land at Wendeng, China, then made final landfall midway between Dairen and the China-North Korea border with an intensity of 45 kt (23 m/sec). The final warning was issued at 160600Z as the remnants of Ellie moved northward over rugged terrain in northeastern China.

III. DISCUSSION

a. Unusual genesis

Most tropical cyclones of the western North Pacific form in the monsoon trough. Ellie was one of few that did not. Some of the few, like Tropical Depression 31W and Yunya (36W), form in the low-level tradewind easterly flow in association with cyclonic disturbances in the tropical upper tropospheric trough (TUTT). Others, like Ellie, form in the subtropics at the base of mid-latitude low-pressure troughs.

The disturbance that became Ellie evolved from an area of deep convection that first appeared at relatively high latitude (30°N) at the base of a weak mid-latitude trough. This area of convection drifted slowly southward and was associated with an intensifying low-level cyclonic circulation. After several days of slow improvement in the organization of deep convection, and a gradual increase in the intensity and size of the low-level circulation, this subtropical disturbance became a tropical cyclone.

b. Large eye and large size.

In its intensifying tropical storm stage, the deep convection near the center of Ellie gradually wrapped around a large (60 nm) relatively cloud-free center (Figure 3-18-2). Satellite analysts were reluctant to call this feature an eye, as significant breaks in the deep convection were evident. However, as the deep convection formed a more complete ring, it was diagnosed as a ragged eye wall at 120530Z, roughly six hours after the image in Figure 3-18-3. For most of its life, Ellie had a large ragged eye with a diameter of approximately 60 nm (110 km). The maximum intensity of Ellie as derived from application of Dvorak satellite imagery analysis was 80 kt (41 m/sec). The Dvorak technique caps intensity at 90 kt (46 m/sec) for typhoons with large ragged eyes; where large is defined as an eye diameter of 45 nm (85 km) or more.

Another of Ellie's structural characteristics was its large size. The size of a tropical cyclone is a fairly difficult parameter to objectively specify. The average radius to the outer-most closed isobar has been suggested as an objective measure of size (Merrill 1984). Another parameter suggested as a measure of size is the average radial distance to the point where the streamlines of the low-level flow become unidi-

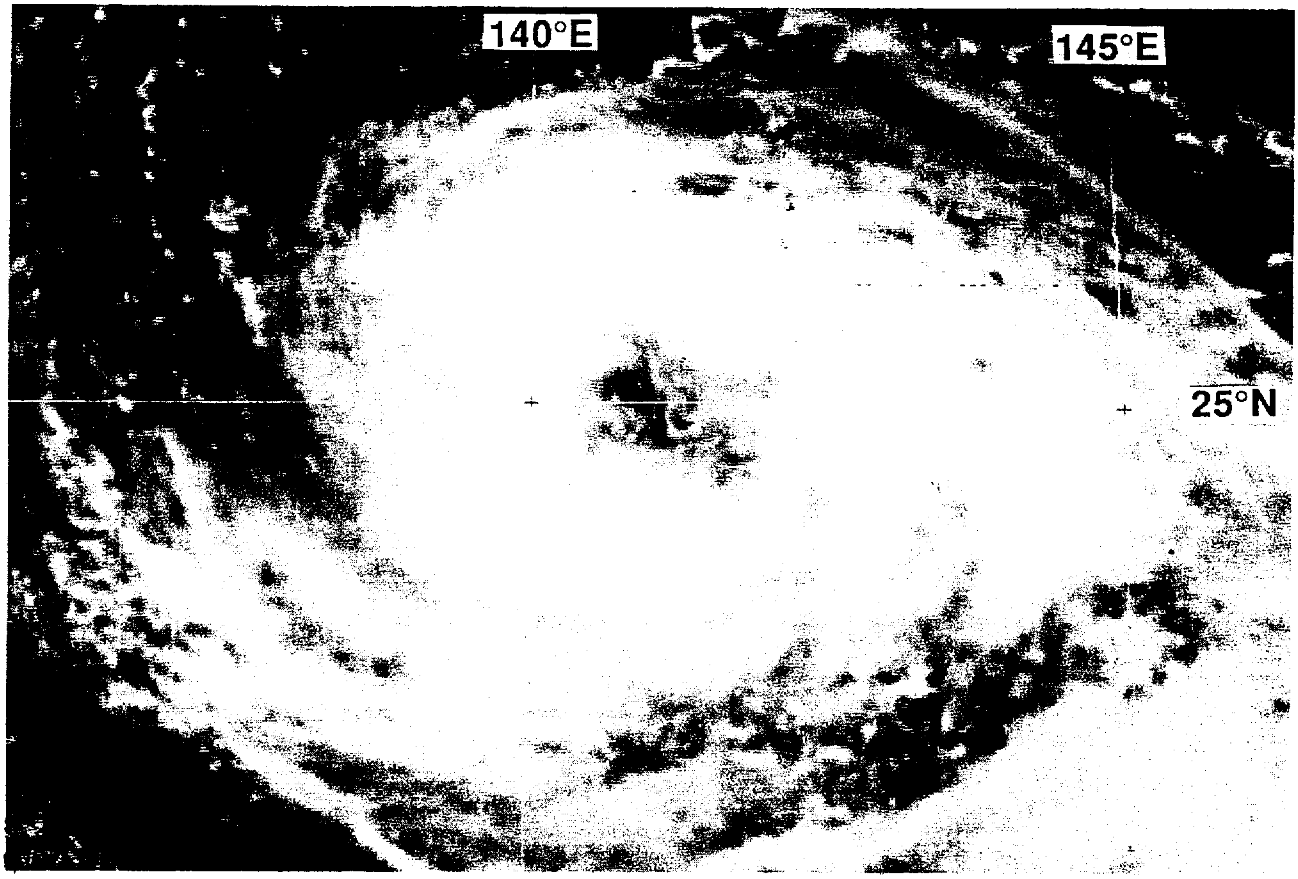

Figure 3-18-2 Ellie's deep convection begins to consolidate around a 60 nm (110 km) cloud-free center that would not be diagnosed as an eye for over another 72 hours (090231Z August visible GMS imagery).

rectional or anticyclonic. In the North Atlantic, where tropical cyclones are usually embedded in low-level easterly flow, the aforementioned size parameters may yield consistent results. However, in the western North Pacific, where tropical cyclones are usually embedded in the monsoon trough, the aforementioned parameters lead to an ambiguity: where does the tropical cyclone circulation end and the monsoon circulation begin? Disregarding the problems of objective determination of tropical cyclone size, it is certainly apparent on satellite imagery (Figure 3-18-3), that Ellie was large.

IV. IMPACT

No reports of injuries or of serious damage were received.

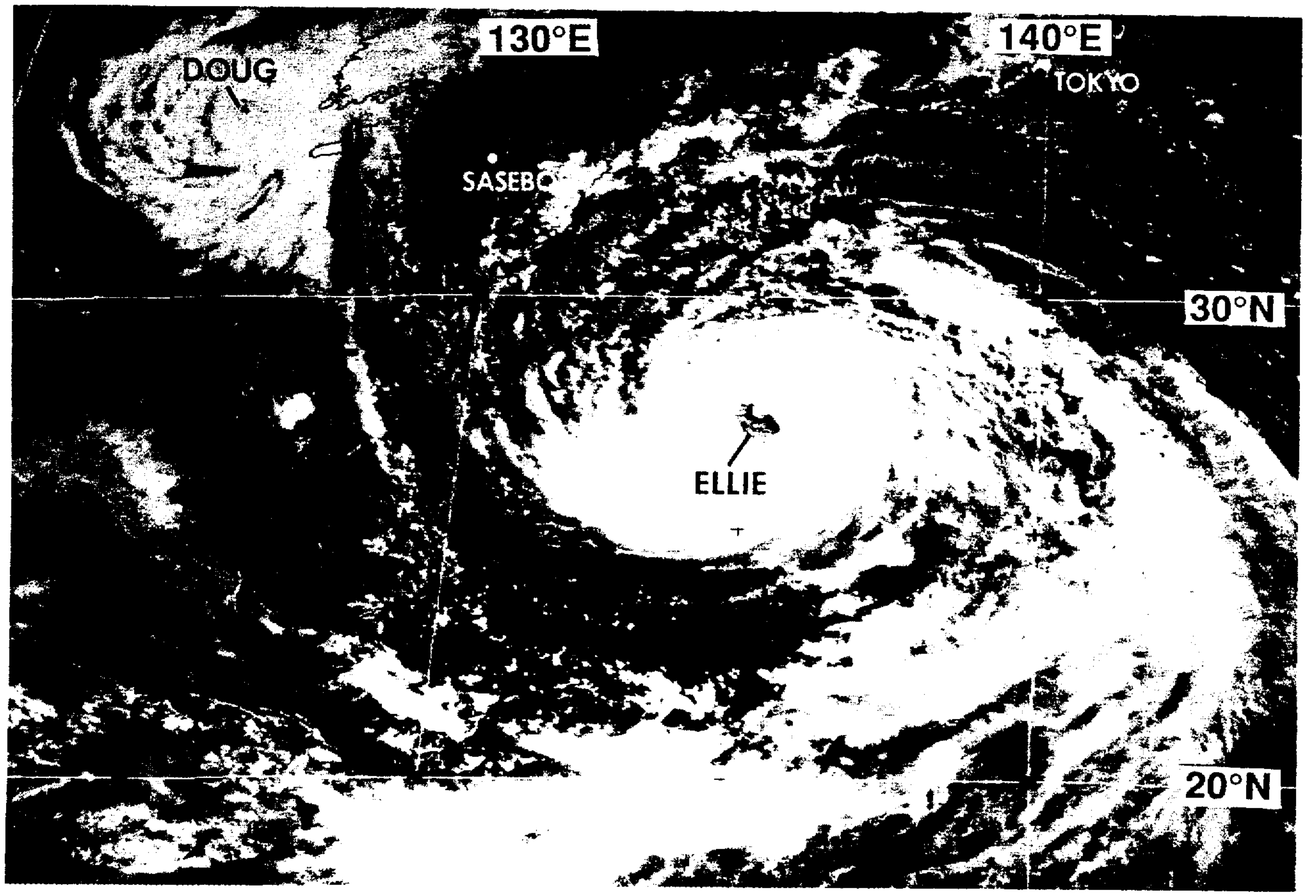

Figure 3-18-3 Ellie possesses a large ragged eye and a large outer circulation (112331Z August visible GMS imagery).

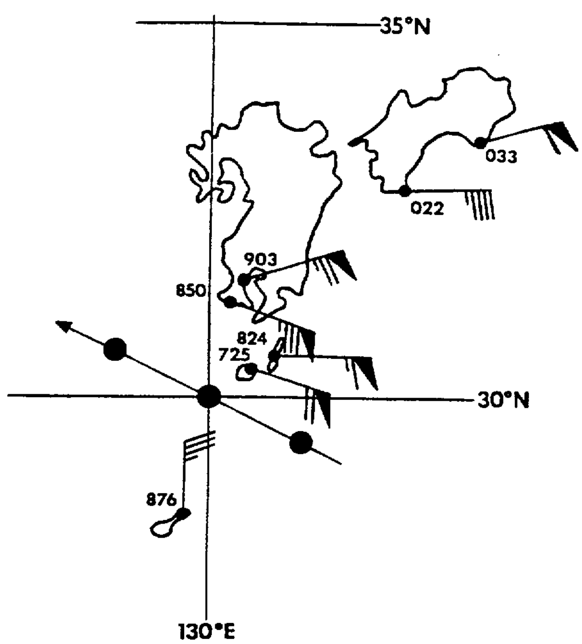

Figure 3-18-4 Maximum wind gusts and minimum sea-level pressure reported at several stations in southwestern Japan as Ellie passed through the region. Ellie's best-track is indicated by large dots. Wind is coded as follows: full barb = 10 kt, flag = 50 kt. Pressure is coded as follows: divide indicated value by 10 and add 900 (or add 1000 to values less than 100) to get pressure in units of millibars.